File SWYTA

[redacted]

DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION
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CHEYENNE, WY 82002

FAX TRANSMITTAL COVER SHEET

No. of Pages: 16 (Cover Sheet Included)

FAXED

DATE: January 19, 1999

TO: SWYTAF Technical Committee (See List Below)

FROM: D. Potter PHONE NO.: (307)777-7391

COMMENTS: **The Division has received some information from Earth Tech which we are forwarding for your review. The attached information addresses the area source sensitivity tests, the SOA module, and initial responses to some of the technical committees questions e-mailed 1/13/99. Based on the information received to date, we will not be able to provide a complete set of comments to Earth Tech on the Emissions Reports on January 21. The Division will once again be requesting a tabular reconciliation of the emissions inventory in tons per year from Earth Tech. At this point the only certain item on the schedule is the January 20, 1999 SWYTAF Meeting in Cheyenne (Earth Tech will not be at the meeting). As additional information is received it will be forwarded to you for your review.**

If you have questions, please feel free to contact me at (307)777-7346 or by E-Mail (dpotte@missc.state.wy.us.)

✓Terry Svalberg (USFS)	-	(307)739-5750	hand delivered 1/20/99
✓Susan Caplan (BLM)	-	(307)775-6082	
✓Dan Heilig (WOC)	-	(307)332-6899	
✓Tamara Blett (USFS)	-	(303)275-5754	1/19/99
✓Otto Schnauber (Tg Soda Ash)	-	(307)872-4233	hand delivered to Mike Wendorf
✓Baptiste Weed (Wind River EQC)	-	(307)332-7579	
✓Doug Blewitt (Amoco)	-	(303)830-4275	hand delivered 1/19/99
✓Dolly Potter (Solvay)	-	(307)872-6510	hand delivered 1/19/99
✓Kevin Golden (EPA)	-	(303)312-6064	
✓Lee Gribovicz (DEQ/AQD)	-	(307)332-7726	hand delivered 1/20/99

Copy: Dan Olson
Bernie Dailey

IF YOU DID NOT RECEIVE ALL OF THE PAGES, PLEASE NOTIFY THE SENDER AS SOON AS POSSIBLE.

OFFICE NO. (307) 777-7391 *FAX NO. (307) 777-5616*

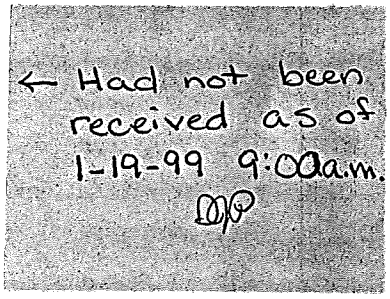
From: Joe Scire <jss@src.com>
To: incdomain.misscsmtp("\"Dan Olson <dolson@missc.sta...
Date: 01/19/99 6:17am
Subject: Schedule

Dan,

My father passed away last week, and I had to be out the office most of the week. Unfortunately, that has impacted the preparation of the technical memos.

I received the comments from Darla on Thursday when I returned, but obviously it was not possible to meet the request to acceleration the preparation of the memos for Friday.

The situation is the following:



- a memo writing up the results of the test runs with receptors located throughout the domain for two episodes was written up and sent along with the plots by FedEx on Saturday (for Monday delivery).

- plots showing the results of the area source sensitivity tests are being faxed to Darla this morning. There hasn't been time to write up the results in a memo, but the plots show the results are not very sensitive to the area source assumptions. This suggests the current configuration is OK.

- a memo on the SOA module was sent by Gary Moore to Darla yesterday (e-mail & fax).

- a set of responses to the comments of the committee is being prepared & will be sent later today.

The boundary condition memo is not ready. I hope that we'll have a set of three plots to fax to you today, but a detailed memo is not likely to be ready for the meeting tomorrow.

Sorry for the disruption in the schedule for the memos. I hope the information provided will be sufficient for a useful discussion at the meeting.

Joe

Joe Scire
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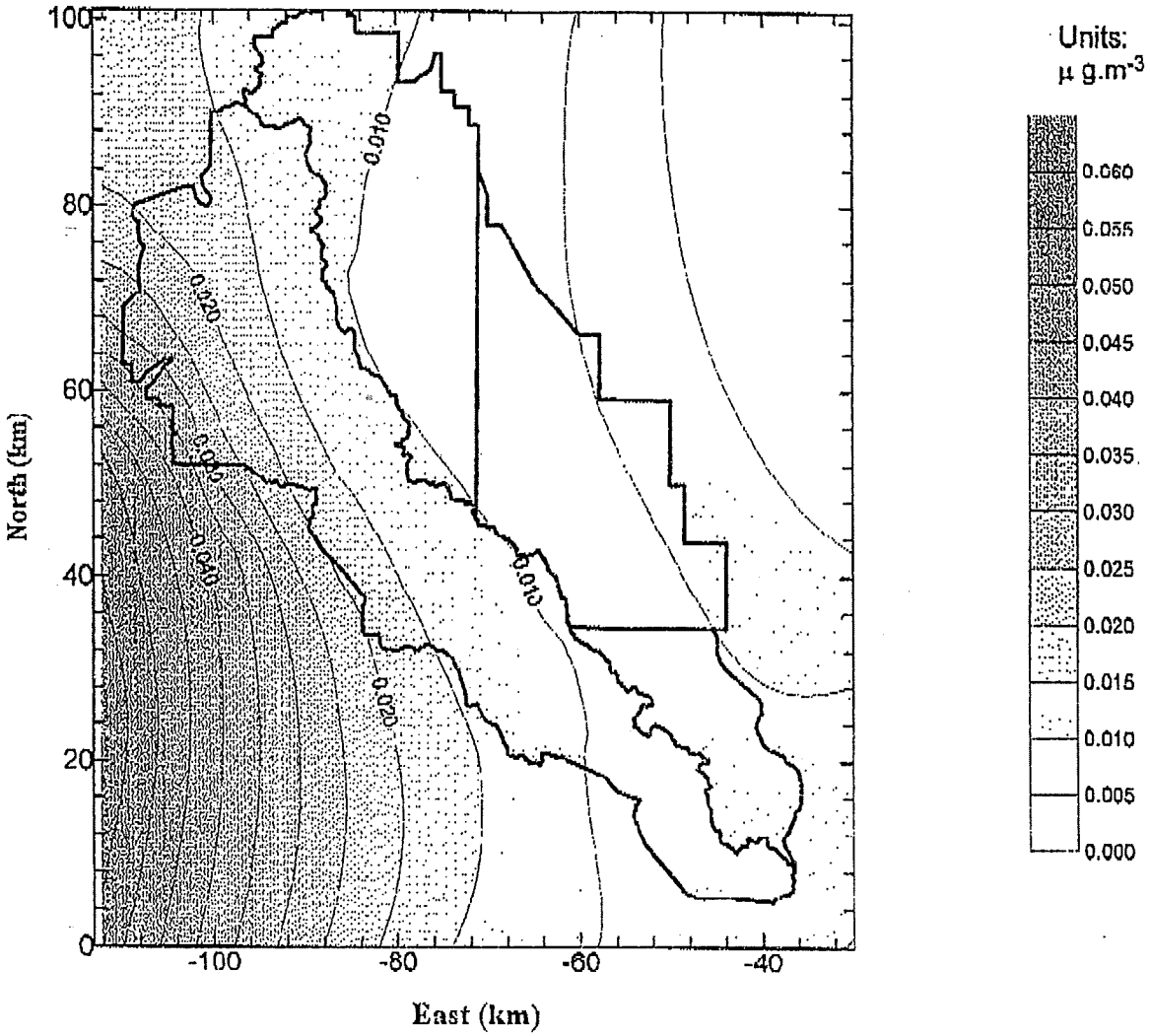
Plots showing results of the area source sensitivity tests.

No technical memo.

PAW-Source Related [NO2] in Bridger Area

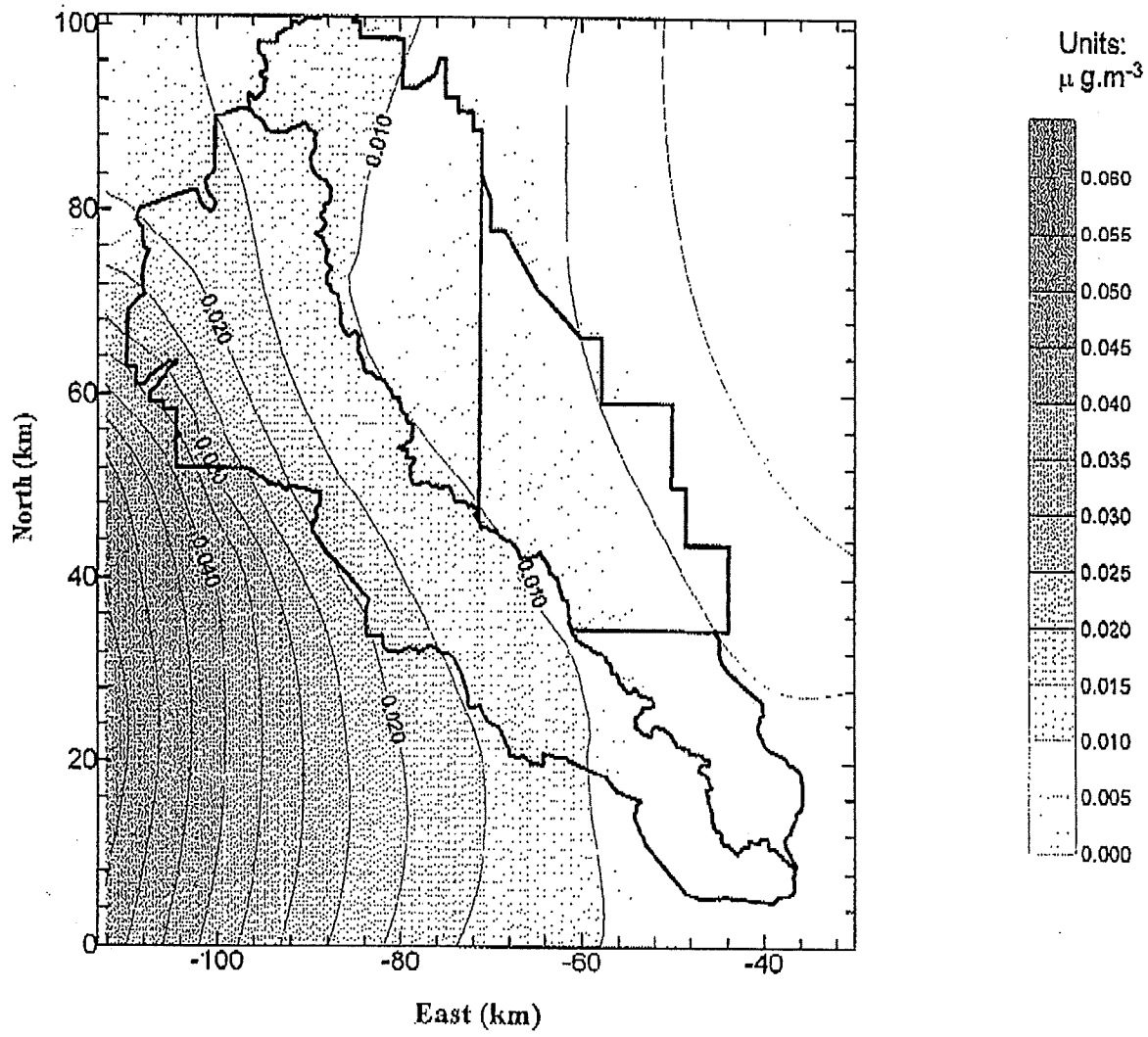
Original Source Parameters on July 12, 1995



e:/projects/swwyt af/9901/1932423p.srf

PAW-Source Related [NO2] in Bridger Area

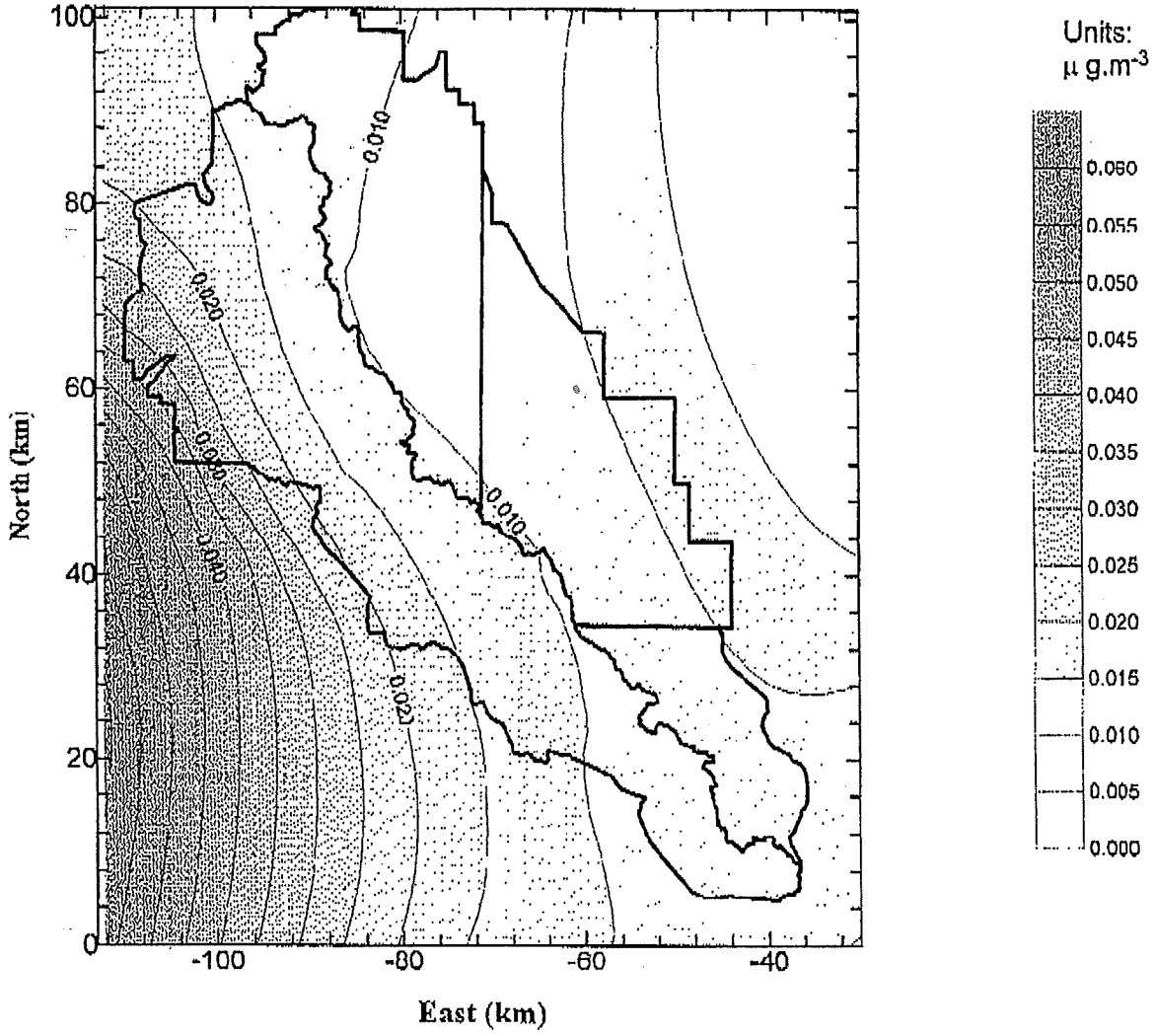
Half-Height Source Parameters on July 12, 1995



c:/projects/swwytaf/0901/1932423q.srf

PAW-Source Related [NO2] in Bridger Area

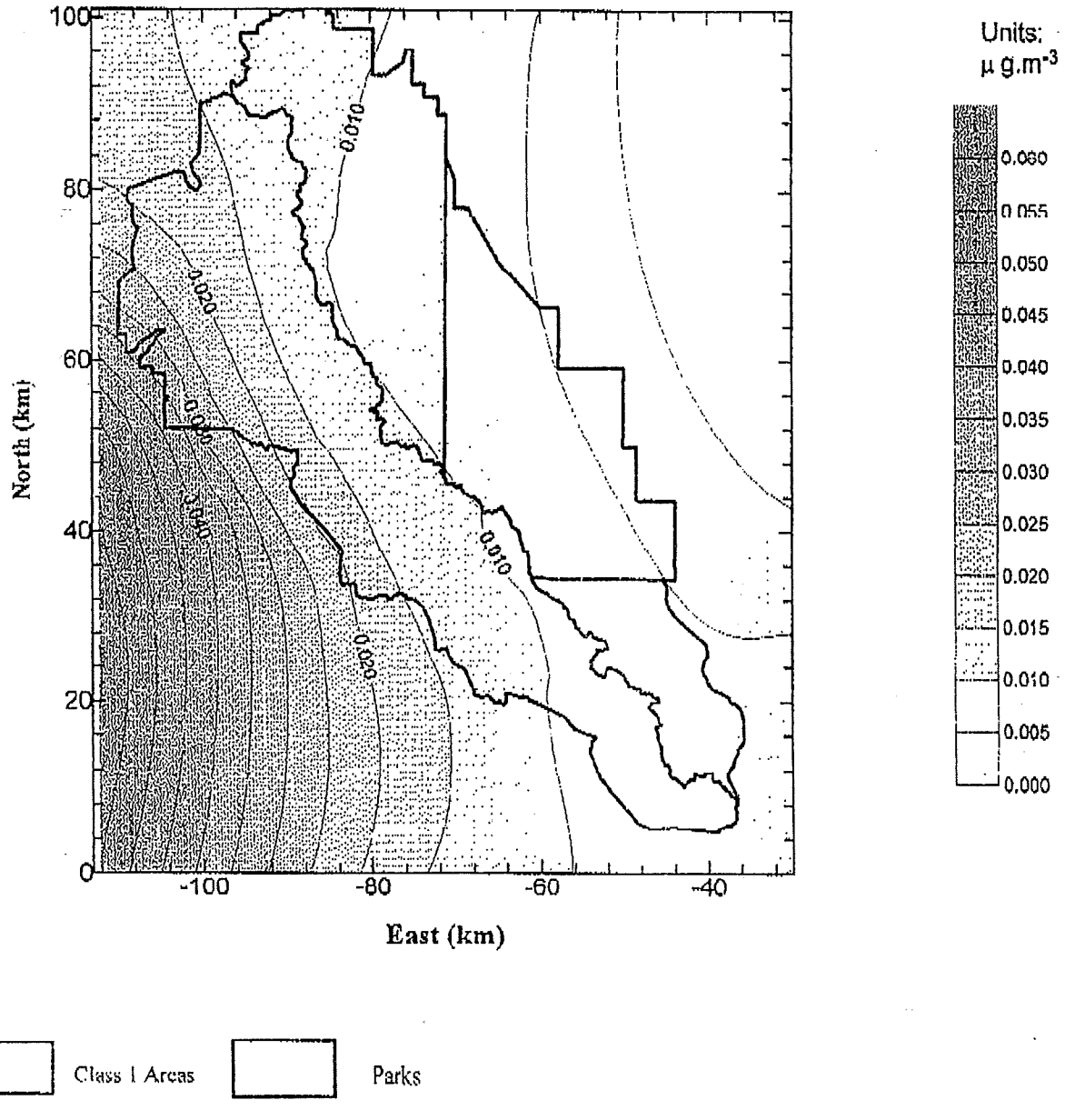
Double-Height Source Parameters on July 12, 1995



c:/projects/swwytaf/9901/1932423r.srf

PAW-Source Related [NO2] in Bridger Area

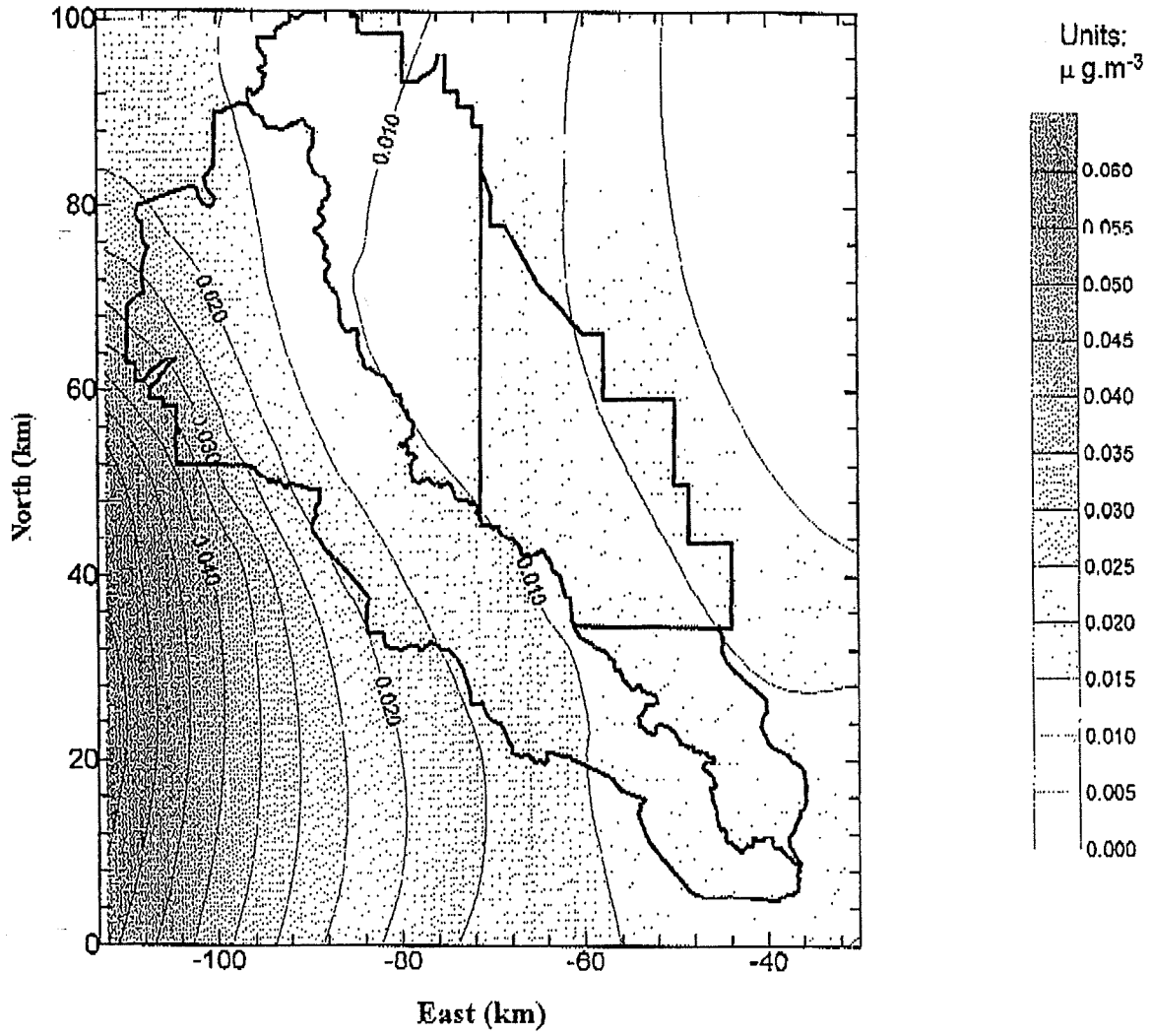
Half-SigmaZ Source Parameters on July 12, 1995



e:/projects/swwytaf/9901/1932123e.srf

PAW-Source Related [NO2] in Bridger Area

Double-SigmaZ Source Parameters on July 12, 1995



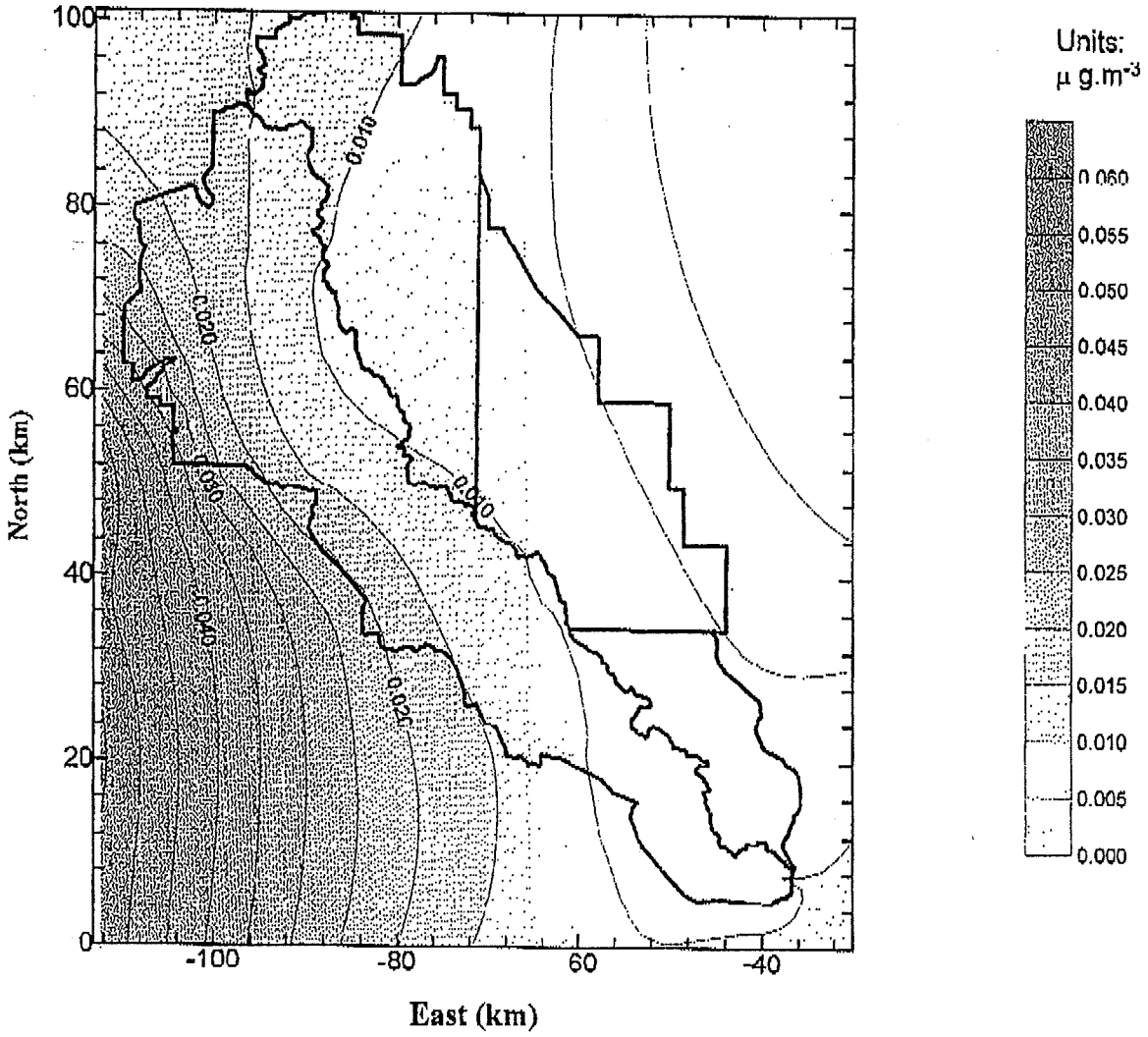
Class 1 Areas

Parks

e:/projects/swwytaf/9901/1932423t.srf

PAW-Source Related [NO2] in Bridger Area

4km-Grid Source Parameters on July 12, 1995



c:/projects/swwytnf/9901/1932423a.srf

Technical Memorandum

Current Status of Secondary Organic Aerosol (SOA) Modeling

The initial SOA modeling exercise indicated a significant degree of model over prediction of organic aerosol. This over prediction was though to occur because of

- Over estimate of biogenic emission factors and plant biomass,
- Inaccurate beta/alpha pinene emission ratio,
- Over estimate of aerosol formation yield based on (1) too large a background organic aerosol mass and (2) incomplete/uncertain yield model, and
- Biases in the specification of the biogenic area sources used in CALPUFF

Earth Tech has looked into the reasons for the initial over estimates and in the process (1) developed several types of conifer canopies, (2) a new area source grid, (3) new beta/alpha pinene emission ratios, and (4) a revised yield model. A correction was also made in the diurnal weights input to CALPUFF so that hourly weights now sum to 1.0. Details of the changes in the biogenic emissions inventory estimation are discussed in volume 1 of the emissions report. A sensitivity study was conducted and in the process a new set of SOA predictions was produced which shows better agreement with the observations of organic aerosol mass over the receptor area. This technical memorandum discusses some results of the revised SOA modeling.

The SOA model itself was revised by the addition of a separate night time yield model for alpha pinene which reacts rather quickly with ozone. The yield curve information of Hoffmann et al. 1997 for dark experiments resulted in a one-product yield model for alpha-pinene for night time conditions. The combination day time - night time yield models produces larger aerosol formation yields than the original generic yield model. This results in a greater daily aerosol formation, counter to what was initially expected given the competition between alpha pinene destruction by ozone and the OH radical.

Sensitivity Testing Results

A sensitivity simulation was conducted using the high emitting canopy described in Table 7-1 of the draft final emissions report. The emission rates are summarized in section 7 of the draft final report. The background ambient aerosol mass was unchanged from the original simulation. CALPUFF was exercised for the month of July.

The observations of aerosols are generally summarized on a quarterly basis by season. The summer sensitivity simulation of SOA covers only the month of July. According to the IMPROVE report the regionally (Central Rockies group) and historically averaged concentration during the summer is 1.8 ug/m3. If the same peak to mean ratio is assumed to occur between months as occurs between seasons the largest observed monthly concentration could be of the order 2.5 ug/m3. The Bridger aerosol monitor lies 10 km east of Pinedale at a ski resort. The

Appendix H of the WY DEQ's 1997 Long Term Strategy for Visibility Protection Review Report shows trend data where at Bridger the organic aerosol observations have apparently declined over time with 1995 data showing summer seasonal average concentrations below 1.0 ug/m3. Biogenic emissions would show interannual differences due to factors like temperature, but would not be expected to show such a decline over time. During July the maximum predicted ambient concentrations of anthropogenic SOA precursors (xylene and toluene) are remain well over an order of magnitude smaller than the corresponding predicted monoterpene ambient concentrations. Trends in the anthropogenic SOA precursors would at present seem to small to have much of an effect leaving the source of trend, if it is real, unaccounted for.

The original maximum monthly mean biogenic SOA concentration for July was 17.4 ug/m3 – clearly an over prediction of SOA. The predicted SOA for the revised high emitting canopy is 3.46 ug/m3, a factor of five-fold reduction and more clearly in line with concentration observations. The maximum daily mean predicted SOA concentration also declined by a factor of five, falling from 41 ug/m3 to approximately 8 ug/m3. The location of the maximum monthly predicted moved from the northern portion of the receptor region to a receptor in the mid-portion of the modeling domain.

Originally the maximum monthly ambient concentration of beta pinene was larger (unmatched in space) than that of alpha pinene, while for the revised run the highest concentrations of alpha pinene are nearly twice as large as for beta pinene. While this is consistent with the emission inputs (8057 g/s versus 4461 g/s) it is not consistent with ambient air observations of Goldman et. al. 1997 made as part of the Tropospheric OH experiment in the Colorado Rockies which show ambient beta/alpha pinene ratios of greater than two. A reversal of the relative emissions ratio 75/25% (beta/alpha) rather than 25/75% is being examined.

Despite the large decrease in the estimated domain-wide total emissions between the original and the revised sensitivity simulations (182,000 g/s versus 12,700 g/s) the ambient monthly mean concentrations actually increased with maximum alpha pinene concentrations rising to 118 ug/m3 from 28 ug/m3. A significant portion of the difference is though to be due to the difference in the configuration of the area source emissions with finer spatial resolution occurring near the receptor area and a closer match with underlying terrain in the revised run.

References

Goldan, P. D., W. C. Kuster, and F. C. Fehsenfeld, 1997. Nonmethane hydrocarbon measurements during the tropospheric OH Photochemistry Experiment, J. of Geophys. Res., 102(D5):6315-6324.

Hoffmann, T. J.R. Odum, F. Bowman, D. Collins, D. Klockow, R.C. Flagan, J.H.Seinfeld, 1997. Formation of Organic Aerosols from the Oxidation of Biogenic Hydrocarbons, J. of Atmos. Chem., 26:189-222.

INITIAL SWYTAF TECHNICAL COMMITTEE QUESTIONS AND COMMENTS

EMISSIONS INVENTORY REPORT
Volume 1
pg 1-3, Section 1.4, Last Paragraph
This paragraph mentions the need to speciate NOx into NO and NO2 but nowhere in the emissions inventory report does it specify how the ratio of NO to NO2 was determined. Technical committee members are inquiring as to how mass was conserved in the conversion from NOx to NO and NO2. It appears from the NO and NO2 emissions summaries in the report as if the fraction of NO2 to NO+NO2 is 14.5%. The technical committee requests to see a discussion and justification of how the ratio was determined as several members feel the percentage is too high. This discussion should also appear in the final emissions inventory report.

> **Response:** On page 2-8 where VOC speciation is discussed the following paragraph will be added:
>
> The standard emssion reporting convention is to report Nox mass emissions as NO2. The speciation breakdown of the Nox emission rate is performed on a molecular basis (e.g. X molecules of NO to Y molecules of NO2). For most combustion sources this ratio is 9:1 where most of the emissions are assumed immediately at the source to be predominantly NO. The NO2-NOx emission relationship is NO2 = 0.1*NOx. Due to the differences in molecular weight the NO-NOx emission relationship is NO = 0.9*NOx*(30/46).
>
> Note - On table 2-4 the NO is 479 g/s and the NO2 is 82 g/s - The reported Nox emissions are 816 g/s so the NO2 component is 10% not 14.5%. If the Nox as NO2 reporting convention has not been followed as part of the reporting - errors will occur since the convention has been assumed in all speciation software.

pg 2-5, Figure 2-2
Please specify in the discussion of this figure if Figure 2-2 is presented only to graphically indicate the amount of reconciliation required between the various inventories or represents the combination of the various inventories in the emissions inventory that is used in the model. If Figure 2-2 represents the emissions inventory in the model then the Division would like to inquire as to some of the sources that appear to be represented twice in two different inventories.

> **Response**: Please note that the location of Figure 2-2 is incorrect. The reference to Figure 2-2 on page 2-4 should actually be Figure 2-1. On page 2-7 paragraph 2 we are changing 'Figure 2-2 shows...' to 'For reconciliation and review purposes only Figure 2-2 shows ....' The two changes should mitigate the confusion.

A tabular reconciliation, in tons per year, of the emissions inventories presented in Volume 1 compared to the data provided by Air Sciences and the Division needs to be received by the

Division by January 15. The current grams per second format of Volume 1 does not allow the Division to reconcile the emissions to those in tons per year provided by Air Sciences and the Division.

Response: The listings in Volume 3 with additional upgraded summaries should suffice. The difference in tons/year and g/s for the time independent sources should be (31,536,000 s/y)/(909000 g/ton) = 34.69 (from g/s to tpy) and between tons/day and g/s should be 0.095 (a quick x10 or 10% rule is used for eyeballing depending on which way one is going). A column will be added to all of the emissions tables in Volume I providing the data in TPY as well as g/s.

pg 4-5, Figure 4-2
This figure indicates that there are two cells of PAW emissions sources in Colorado. PAW emissions sources should only exist in Wyoming (refer to Volume 2, Figure 3.1). Are the cells graphically misaligned or is this due to how the wells were assigned to a grid cell? This should be examined and discussed in the report

Response: The spreadsheets provided by both PAW/AIR SCIENCES and WY DEQ have a row of nonzeros cells whose bottom and top latitudes are 40.83 deg N, 41.00 deg N. It was recognized that the WY-CO boundary is at 41 deg N (exactly). The well information clearly extends into CO. If the original PAW & WY DEQ coordinates are in error for these sources, please advise.

pg 5-19, Tables 5-16 and 5-17
The Division's memorandum on the quantification of railroad emissions (From Greg Meeker on 3/17/97) included a quantification of the SO2 emissions. The current inventory has omitted the quantification of SO2 emissions from trains. Please revise the railroad emissions to include SO2. The conversion of 385.9 grams per second NO + NO2 does not equate to 30,350 tons per year NOx. The Division calculated 13,414 tons per year NOx based on 385.9 grams per second NO + NO2.

Response: The SO2 emissions will be added to the modeling inventory as per Meeker's March memo supplied by the Division this last fall. The summary tables in the final report will be revised to include SO2.

Two factors lead to the calculated discrepancy in the NO/NO2 emission summaries. First is the reporting of NOx as NO2. The second factor is that Earth Tech had to remove the Utah rail emissions due to the fact that they are present in the Utah county area source emissions in order to avoid double counting. This is reflected in the fact that the rails and roads disappear at the Utah border in Figure 5-2. The 30 K tons tons represent the domain-wide total, but the amount of emissions actually put into CALPUFF as rails (in the rail group) does not include Utah railroads. Thus for roads and rails there is some inter-mixing between emission groups. Since the exact numbers used by Utah in the county totals were not provided an accurate subtraction of such sources from the county

values was not possible.

pg 7-8, Table 7-3
The emissions rates for alpha pinene and beta pinene are presented for both the high and moderate emission canopies but there is no discussion as to when and why each of the emissions rates is used in the emissions inventory.

Response: This confusion will be clarified on the basis of the sensitivity modeling findings. The following will be added to the end of page 7-8.

The satellite NDVI for the conifers in the Tetons during July-August of 1995 is greater than 0.6 suggesting a relatively high biomass density forest. The sensitivity analysis results suggest that the denser and greater emitting species provide better agreement with observations of organic aerosol mass during the winter and summer than the other canopy types.

Volume 2
Monthly emissions rates were provided to Air Sciences for Amoco's Whitney Canyon Gas Plant by Amoco Production Company. If was not clear if the monthly emissions rates were included in Volume 2 of the emissions inventory and hence included in the Earth Tech emissions inventory feeding the model.

Response: Yes they are in Volume 2 and yes they are in the CALPUFF emissions inventory (see Volume 3).

pg 22, Table 2.8
The default stack parameters for the Refinery Flare are not reasonable and could cause stack tip downwash problems. These parameters should be revised.

Response: The defaults were used for Utah sources, representing a very small emissions source very far from the receptor region. The low number was obtained from the State of Utah and the uncertainty in the velocities of flare emissions are very large owing to the strong coupling to both mode of operation and configuration and to the prevailing meteorological conditions. The mean of flares in WY could be substituted, but it is not likely to have any significant impact on the modeling results.

Appendix G, Section II
The cord volume and wood density are incorrect according to one of our technical committee members. Based on information in the Forestry Handbook, Second Edition (copy attached) for Douglas Fir the volume per standard cord should be 92 ft3 (a gross cord is 128 ft3) based on Table 22 and the dry weight of wood is 2277 lb per cord based on Table 7. This error effectively cuts the emissions from wood burning in half. This error was pointed out to Air Sciences by one of our technical committee members at the March 2, 1998 technical committee meeting on the

draft Air Sciences emissions inventory in Cheyenne.

Response: The comments were reviewed by Rodger Steen, and he believes the data in the final report is correct. Rodger has been asked to provide a more detailed explanation.

Volume 3

Please double check to make sure that the emissions for a facility with a CEMS are not double counted in the point and area source emissions for that facility.

Response: This will be done.

SOURCE GROUPING

Task 3 calls for "...the final modeling results...to estimate the 1995 contribution of major source categories...". To keep with the intent of this statement in Task 3, the Division and the technical committee have reorganized the current source groupings to better represent the "major source categories". The new source groupings appear below.

NO.	Group	Type
1	Utah	Include sources in Utah from the previous County Points and County Areas groupings.
2	Idaho	Include sources in Idaho from the previous County Points, County Areas, Cities, Highways, and Railroads groupings.
3	WY Cities	Modify to only include Wyoming city emissions.
4	WY Mobile	Modify to include Wyoming highway, railroad, and unpaved road emissions.
5	Power Plants	Include Power Plants in Wyoming and Colorado from the previous County Points, County Areas, CEM, and CEMXS groupings.
6	PAW	Stays the Same
7	Fires	Stays the Same
8	Trona Industry	Include Trona Facilities in Wyoming from the previous County Points, County Areas, CEM, and CEMXS groupings.
9	Gas Processing	Include Gas Plants and Compressor Stations in Wyoming from the previous County Points, County Areas, CEM, and CEMXS groupings.
10	Miscellaneous Facilities	Include all Wyoming sources not grouped in Power Plants, Trona Industry, and Gas Processing groupings from the previous County Points, County Areas, CEM, and CEMXS groupings.
11	BIO-VOC	Stays the Same
12	Ammonia	Stays the Same

Why is a source grouping for ammonia necessary?

MODEL OUTPUT

Are the discrete receptors identified in the contract already in the model? The receptor figure presented at the past few meetings only identifies a few discrete receptors.

Does the fine receptor grid (4 km) extend outside of the Class I areas or terminate at the Class I area boundary receptors?

The technical would like Earth Tech to provide suggested dates for the episodic runs for review, discussion, and approval.

REMAINING TASKS/SCHEDULE

The Division would like to receive the technical memorandums on January 15 so that they may be distributed to the technical committee for review and intelligent discussion at the January 20 SWYTAF meeting. As January 18 is a holiday for some people it would not be possible to grant them enough review time prior to the January 20 meeting if the memorandums are not received until the 18th.

A technical memorandum on the additional biogenic/secondary organic aerosol tests mentioned at the 12/2/98 SWYTAF meeting should be provided with the other technical memorandums on January 15.

The CALPUFF discussion at the January 20 SWYTAF meeting will focus on the Boundary Conditions and Biogenics Technical Memorandums as well as the reconciled emissions inventory and oil and gas emissions inventory. We are hoping to provide feedback to Earth Tech on January 21 on the Boundary Conditions and Biogenics Technical Memorandums as well as the Emissions Reports. Does Earth Tech need feedback on any other technical memorandums on January 21?

The Division will have to receive the January 18 (15) technical memorandums and responses to our questions/comments in this e-mail prior to committing to a schedule for the remaining tasks, including committing to a firm date for providing comments on the Emissions Reports.

Seven days is not enough time for the Division to distribute the report to the technical committee, allow review of the report, and receive feedback to synthesize and compile for Earth Tech. The Division believes that this time frame needs to be more like 2 ½ weeks to allow adequate time for distribution, review, and feedback.

A portion of the revised timetable as modified from Earth Tech's 1/7/99 letter is as follows.

January 12 Technical Committee Conference Call

January 18**(15)** Technical Memorandums on Deposition Flux Analysis, Episodic Modeling, Source Aggregation Tests and Area Source Sensitivity Tests, Boundary Conditions, and **Biogenics** to Division for Distribution to Technical Committee

January 20 SWYTAF Meeting in Cheyenne (Earth Tech will not be present)

January 21**??** Comments on Emissions Reports and **Boundary Conditions and Biogenics Technical Memorandums** to Earth Tech **(5 working days after receipt of Technical Memorandums listed)**

January ?? **Comments on Remaining Technical Memorandums to Earth Tech (5 working days* after receipt by Division) *assumes technical memorandums are 1 to 2 pages each and can be faxed to technical committee members**

January 31 **??** Changes to Emissions Database Complete
Technical Memorandum on Relative Humidity Sensitivity to Division for Distribution

When are you planning on having the final emissions inventory report complete and delivered to the Division?